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Zero Waste to Landfill: an Unacknowledged Supermegaproject

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ABSTRACT

Zero Waste is a global movement focused on replacing linear resource-to-waste systems with circular systems found elsewhere in nature, and Zero Waste to Landfill (ZWtL) is a specific interpretation implying the total elimination of residual disposal. Local governments worldwide have declared ZWtL goals with specific deadlines; however, to date none of these initiatives have proven successful. A grounded case study of ZWtL campaigns was conducted to investigate this chronic failure. The results indicate that ZWtL is an unacknowledged supermegaproject: requiring extremely deep and unprecedented change and sacrifice across all sectors, yet destined for failure because proponents fail to recognize the scope of the task and plan accordingly. Strategies for addressing waste upstream are critically absent, with insufficient downstream measures such as recycling the prevailing norm – reinforced by a consistent preference for technical solutions over fundamental behavior change.

1. THE CONTEMPORARY WASTE PROBLEM

Modern human society is based predominantly on linear systems of manufacturing,[1] with raw materials converted into mass-produced items largely designed for rapid obsolescence and disposability,[2] and made increasingly from problematic materials which defy efforts at resource recovery,[3] all of which fosters a dependence on developing new landfill sites for residual waste disposal.

Municipal solid waste generation is estimated to have been 1.2 kg/person/day worldwide in 2010, and is predicted to rise to 1.4 kg/person/day by 2025. Taking population increase into account, total generation is expected to increase from 1.3 to 2.2 billion tonnes/year over this period.[4] This is equivalent to a global output of 40 tonnes *per second* in 2010, expected to grow to 70 tonnes per second by 2025.

The environmental impacts of waste include the contamination of air, soil, and water by a myriad of different human-synthesized chemicals,[5] with toxic impacts on health.[6] Landfilling of waste is an insufficient solution, as partial decomposition in the ground leaches concentrated volumes of these substances into surrounding soil and water.[7] Meanwhile, the alternative option of waste incineration produces toxic particulates which spread throughout the atmosphere and fall onto land and water; and in any case incineration is not a complete alternative to landfilling as it produces toxic ash residue which requires disposal.[8]

** We wish to thank all who offered their time and energy in pointing the way to documents or provide interviews. This includes people at the ACT, Christchurch City Council and Environment Canterbury, City of Toronto and Province of Ontario, SF Environment and the State of California, and many independent sources as well. The piecing together of this story of zero waste to landfill would not have been possible without their efforts.*

[1]. Fricker 2003; Watson 2009.
[2]. van der Werf and Cant 2012.
[3]. Hoornweg and Bhada-Tata 2012.
[4]. Hoornweg and Bhada-Tata 2012.
[5]. Danilov-Danil'yan, Losev, and Reyf 2009; Meadows, Randers, and Meadows 2005; Rios, Moore, and Jones 2007.
[6]. Carroll 2008; Meadows et al. 2005; Puckett et al. 2002.
[7]. Murray 2002; Watson 2009.
[8]. Danilov-Danil'yan et al. 2009.

The widespread manufacture of products from poorly degradable synthetic materials such as plastics, with these materials forming a significant portion of what is ultimately landfilled,[9] means that the rate of waste generation far exceeds the rate at which resources can be converted back to their primary forms. The net result is that landfilling represents an unsustainable steady loss of finite land to waste disposal. In some places available land for new landfills has already run out, leading to immediate crisis and offloading of waste via exports to neighbouring or distant locations.[10]

2. ZERO WASTE, AND ZERO WASTE TO LANDFILL IN PARTICULAR

In response to the long-term unfeasibility of linear resource-to-waste systems, Zero Waste has arisen as an alternative concept, based upon circular resource-to-waste-to-resource systems such as those found throughout nature[11] and evolving from grassroots ideology to become part of official waste policy in local governments around the world.

Zero Waste initiatives span a wide variety of intended meanings, ranging from merely aspirational goals of general waste reduction without specific targets, to the most ambitious goal of Zero Waste to Landfill – 100% elimination of landfilling, with firm deadlines for achieving this. For this study, ZWtL with a specific deadline is of particular interest, as it is only this most extremely ambitious target that implies a paradigm shift from linear to circular systems.

The original research plan was to conduct an investigation of ZWtL initiatives at the local government level, with the aim to identify key factors which drive success versus failure. However, the initial research into such initiatives around the world revealed a significant finding: that there appears to be no exemplar anywhere of successful ZWtL attainment, with failure or looming failure noted in every single observed campaign.

In response, the focus of this study was shifted to asking the question of why ZWtL initiatives are consistently failing, and the follow-up question of what would have to happen in order to turn this failure into success.

3. METHODOLOGY FOR EVALUATING ZERO WASTE TO LANDFILL INITIATIVES

Grounded Approach to Theory

The chronic failure of ZWtL initiatives is a relatively recent phenomenon, with the earliest deadlines set for around 2010. As such, the literature contains a dearth of relevant material, presenting an opportunity for this research to fill a void in the discourse, but also posing a challenge with respect to identifying an obvious theoretical framework upon which to build the study.

In response to the relative newness of the topic of ZWtL failure, a grounded approach to theory was adopted, in which the initial investigation of ZWtL initiatives was conducted without any focus on pre-selected theoretical models.[12] Instead, the initial data collected was examined to identify emergent recurring patterns, and the literature was then canvassed for appropriate theory, with these patterns in mind. Theoretical models were applied to the data, until an overall framework was developed which best addressed the research questions. New questions which emerged sent the research back to examining ZWtL initiatives as well as the literature, resulting in a characteristically iterative process[13] that ran until a refined theoretical framework was established. Where existing theory left a residual gap, new theory was developed to address it, with the overall framework then tested against the data in a final addressing of the research questions.

Case Studies

With the initial finding that no ZWtL success exemplars were evident anywhere, the study population consists of *all* such initiatives

[9]. Barnes, Galgani, Thompson, and Barlaz 2009.
[10]. Brown 2008.
[11]. Fricker 2003; Murray 2002; Watson 2009.
[12]. As per, for example, Glaser and Holton 2004.
[13]. See, for example, Corbin and Strauss 1990; Gurd 2008.

worldwide – including not only already-failed/abandoned campaigns but ongoing ones as well, as the latter appear to be headed for similar failure/abandonment. The large, ever-changing, and globally distributed overall set of ZWtL initiatives precluded census-type coverage of all of them, while at the other extreme a single case study was deemed to be insufficient to capture the variation across all campaigns, with respect to factors such as geography, government type, and position on the timeline between launch and deadline or abandonment.

As ZWtL initiatives cannot be studied in a controlled, experimental manner, a case study approach was selected,[14] based on non-random selection of cases aiming for an appropriately diverse set.[15] Therefore, a sample size of three to five initiatives was targeted, to enhance diversity within study constraints. Random selection of cases was ruled out, as it carried the inherent risk of missing out on cases which possessed unique characteristics of particular interest, and also because this feasible range of sample size was an order of magnitude smaller than the minimum seventy or so required to offer statistically significant measurements.[16]

The following four case studies were selected:

- Australian Capital Territory (ACT) – Canberra and surrounds, Australia:
  - First local government ZWtL initiative in the world, launched in 1996 with 2010 deadline.[17]
  - ACT is a dual city/territory, governing both the city of Canberra and the surrounding capital district of Australia.[18]
  - Initiative was abandoned in 2009, one year ahead of the target date.[19]
- Christchurch, New Zealand:
  - Launched in 1998 with 2020 deadline.[20]
  - Local government initiative operated alongside New Zealand's aspirational-only campaign,[21] the first national-level Zero Waste initiative in the world.
  - Local initiative was largely abandoned after only three years in 2001,[22] and eventually dropped entirely in 2006,[23] followed by the abandonment of the nationwide campaign in 2010.[24]
- Toronto, Canada:
  - Launched in 2001 with 2010 deadline.[25]
  - Potential landfill availability crisis was a significant driver, with the last local site about to fill up, and with shipments of waste across the border to the USA facing increased public and political opposition.[26]
  - Initiative was abandoned in 2007, after a new landfill site was secured within Canada.[27]
- San Francisco, USA:
  - Launched in 2003 with 2020 deadline.[28]
  - ZWtL initiative is highly publicized by the City, particularly the percent diversion from landfill rate which is reported to be the highest in the USA.[29]
  - Initiative is ongoing.[30]

[14]. As per Rowley 2002.
[15]. See, for example, Flyvbjerg 2006.
[16]. See, for example, Bartlett, Kotrlik, and Higgins 2001.
[17]. Australian Capital Territory 1996.
[18]. ACT Government 2013.
[19]. "Rubbish Target Purely Aspirational: Stanhope". Australian Broadcasting Corporation, January 22, 2009. Available at http://www.abc.net.au/news/2009-01-21/rubbish-target-purely-aspirational-stanhope/273440.
[20]. Christchurch City Council 1998.
[21]. New Zealand Ministry for the Environment 2002.
[22]. Christchurch Press, September 8, 2001, WE6.
[23]. Christchurch City Council 2006.
[24]. New Zealand Ministry for the Environment 2010.
[25]. City of Toronto 2001.
[26]. Flynn 2011.
[27]. City of Toronto 2007b.
[28]. SF Environment 2003.
[29]. Lehmann 2011.
[30]. SF Environment 2013b.

Combination of Qualitative and Quantitative Methods

This study employed a mixture of qualitative analysis of policy implementation and stakeholder perspectives, as well as quantitative analysis of reported waste generation over time.

Analysis of policy implementation consisted of a chronological study of decisions and actions, beginning with events preceding the declaration of the ZWtL goal, and leading up to the initiative failure/abandonment and/or beyond to the present day. Data collected for this consisted mainly of a combination of official government documentation, responses to queries from government staff and elected officials, and site visits to each location. Relevant discourse from the literature provided additional information for each case.

Stakeholder perspectives were obtained via interviews, combining face-to-face meetings conducted during site visits, telephone conversations and email exchanges as necessary. Stakeholders were divided into three major groups: *Government*, including elected officials and staff; *Industry*, including waste producers and handlers; and the *Public*, including individuals and grassroots organizations. In keeping with the grounded approach of this study, interviews were mostly in a one-to-one format, with open-ended questions aimed at eliciting an enhanced and triangulated understanding of the history, people, and relevant factors surrounding each initiative. Quantitative or scale-type questions were not included in the interviews, as the number of available people in each stakeholder group was as low as just one or two in some cases, giving very small samples that would preclude meaningful statistical analysis. Rather, the interviews served the important purpose of shedding light on aspects of each initiative that were not revealed by policy documentation or the literature. This function served to drive the iterative, constant comparison process of the overall grounded approach to the study.

It was initially intended that this study would include a quantitative analysis comparing each case study's waste stream profile, broken down into constituent components, with specific strategies that targeted each component. However, none of the proponents could provide a comprehensive set of strategies targeting specific components of their waste streams. From a methodological standpoint, this meant that it was not possible to conduct the intended waste stream component–strategy articulation analysis, for any of the cases.

More importantly, though, this situation represents in itself a remarkable finding: the existence of a *planning void* in each of the initiatives, which as discussed later is a significant element in the overall phenomenon of ZWtL initiative failure.

Another limitation to quantitative analysis is the incomplete and inconsistent nature of waste data, as collected and reported by local governments.[31] The waste stream for each location is not fully measured, particularly where waste is handled by private contractors who, for commercial sensitivity reasons, may not be required to provide complete data. Where data is recorded or estimated, it is difficult to make comparisons across cases because different governments use different classifications for waste types, and what might be counted as landfilled waste in one jurisdiction might be recorded as diverted waste in another, due to subjective crediting such as for the use of waste as alternative daily cover in disposal sites.[32]

Despite these limitations, the year-to-year data available, of total waste generation broken down into diverted and landfilled amounts, provided a useful cursory picture of overall trends, which informed the bigger picture of chronic ZWtL initiative failure, and in accordance with the grounded approach directed the research to further qualitative investigation.

4. RESULTS

Waste Generation Trends

Table 1 gives a summary for each case study initiative, including year of launch, deadline, and year of abandonment and replacement

[31]. See, for example, Hoornweg and Bhada-Tata 2012; Murray 2002.

[32]. See, for example, California Department of Resources, Recycling and Recovery 2012.

goal/deadline, where applicable. The table also shows per capita waste to landfill and percent diversion statistics, at the time of launch, abandonment (where applicable), and most recently reported year.

	Canberra	Christchurch	Toronto	San Francisco
Year Launched	1996	1998	2001	2003
Target Year	2010	2020	2010	2020
Per Capita Waste to Landfill, Year of Launch (kg/person/year)	820	740 (1999 – earliest available data)	740	820
Percent Diversion, Year of Launch	42%	21% (1999 – earliest available data)	19%	60%
Year Abandoned	2009	2001	2007	Ongoing
Per Capita Waste to Landfill, Year Abandoned (kg/person/year)	610	700	640	N/A
Percent Diversion, Year Abandoned	73%	21%	25%	N/A
Per Capita Waste to Landfill, Most Recent Year (kg/person/year)	740 (2011)	450 (2010 – last year pre-earthquake)	560 (2011)	500 (2010)
Percent Diversion, Most Recent Year	75% (2011)	40% (2010 – last year pre-earthquake)	27% (2011)	77% (2010)
Replacement Goal	Zero Waste to Landfill	320 kg/person/year Waste to Landfill	70% Diversion	N/A
Target Year	None	2020	2010 (currently under review)	N/A

Table 1: Zero Waste to Landfill Initiative Results Across Cases.

The data in Table 1 shows considerable variation across cases, with respect to the length of time between initiative launch and target year, ranging from nine years for Toronto to twenty-two years for Christchurch. Notably, Christchurch's initiative was the shortest-lived as it was abandoned after only three years, while Canberra's lasted the longest at thirteen years before being dropped with failure looming just one year ahead of its deadline; San Francisco's initiative, meanwhile, is ongoing and ten years into its seventeen-year scheduled timeline. Another area of distinct variation across cases is the percent diversion rate: at initiative launch this ranges from 19 percent for Toronto to 60 percent for San Francisco; at initiative abandonment it ranges from Christchurch's 21 percent to Canberra's 73 percent; and the most recent rates vary from Toronto's 27 percent to San Francisco's 77 percent.

With respect to per capita waste to landfill, however, the data is quite similar across all cases, ranging from 740 kg/person/year (Christchurch and Toronto) to 820 kg/person/year (Canberra and San Francisco) at the time of initiative launch, and from 610 kg/person/year (Canberra) to 700 kg/person/year (Christchurch) at the time of abandonment. Also in all cases, there has been an overall decrease in this rate between launch and abandonment – with a similar downward trend in San Francisco between its campaign's beginning and most recent results.

Figures 1-4 show waste data for each of the case study locations, from around the start of their respective ZWtL initiatives, until the most recent available year. Total per capita waste generation is shown, along with the breakdown into diverted (from landfill) and landfilled amounts.

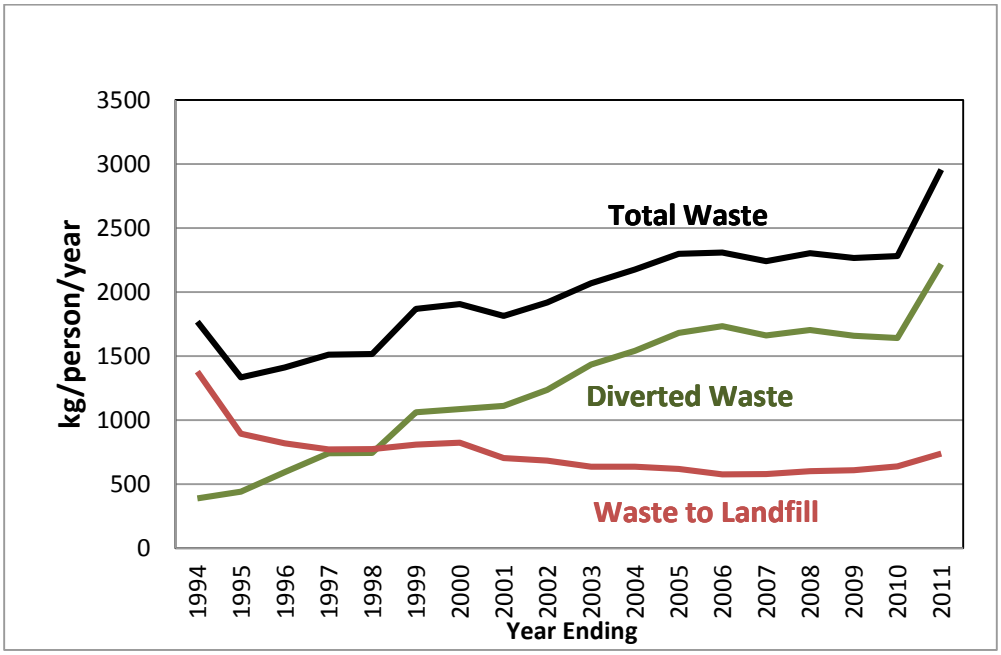

Figure 1: Waste Generation Trends in the ACT.

Sources: ACT Government Chief Minister and Cabinet 2011; ACT Government Territory and Municipal Services 2013.

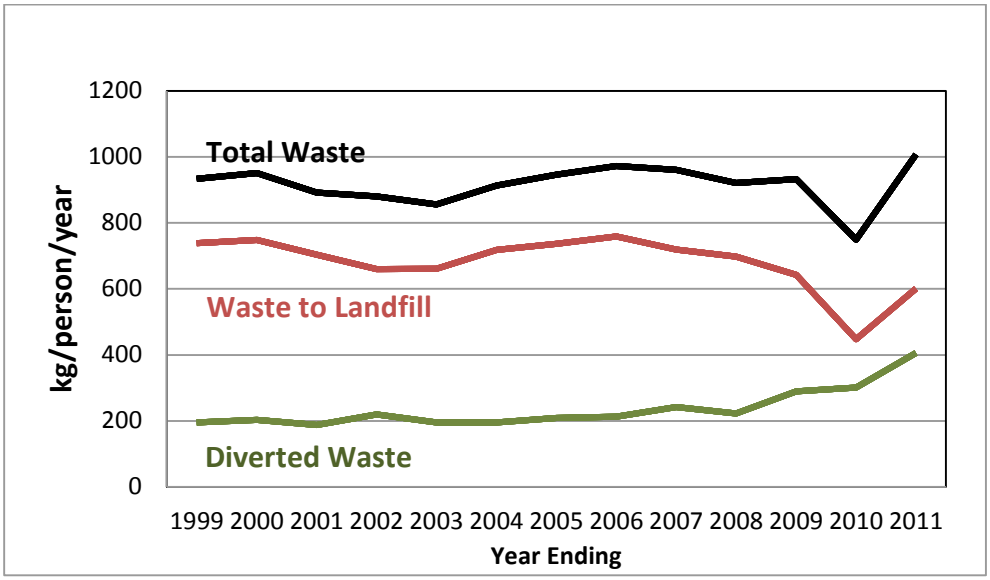

Figure 2: Waste Generation Trends in Christchurch (Note the sharp increase in waste amounts subsequent to first large earthquake event in 2010)

.Sources: Environment Canterbury 2008, 2012a,b.

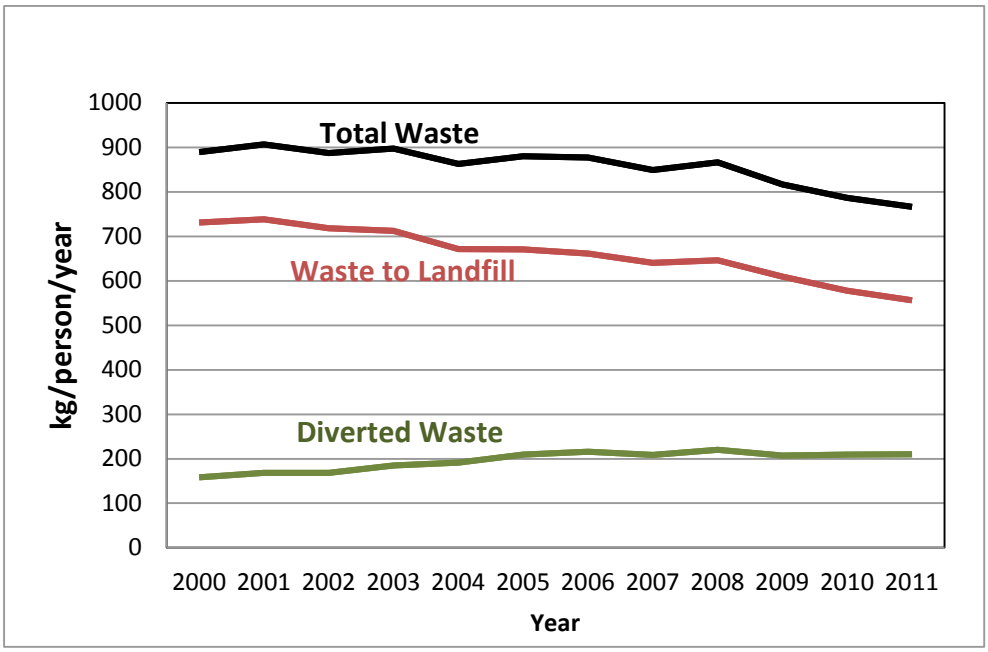

Figure 3: Waste Generation Trends in Toronto.

Sources: City of Toronto 2012a,b, 2013; Ontario Waste Management Association 2012.

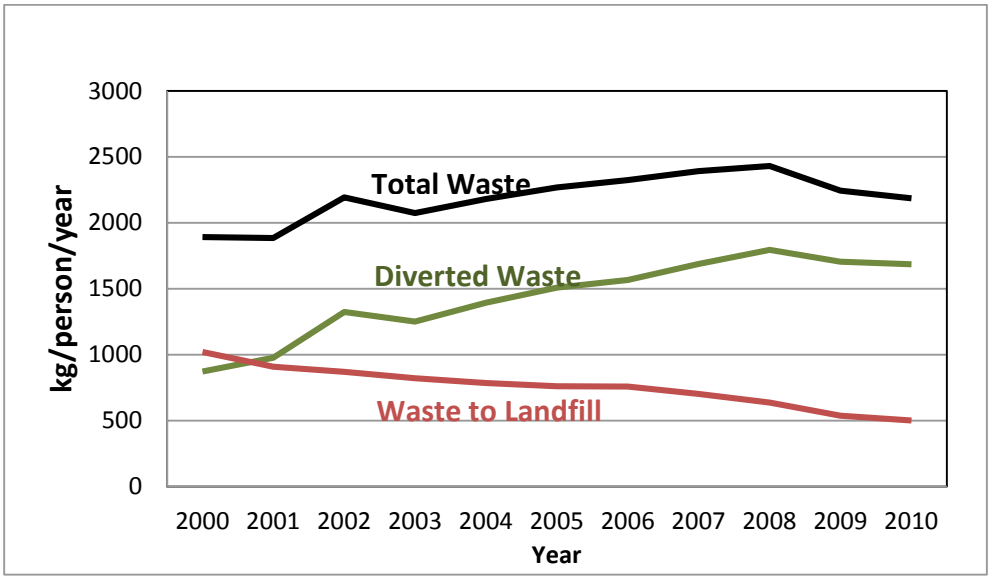

Figure 4: Waste Generation Trends in San Francisco.

Sources: California Department of Resources, Recycling and Recovery 2012; SF Environment 2012a; United States Census Bureau 2012.

In all four cities, the reported per capita rate of diverted waste has steadily increased over time, reflecting increases in the percent diversion rate, with Toronto at the lower end increasing from 19 to 27 percent, and San Francisco at the higher end rising from 60 to 77 percent.

Meanwhile, all locations have reported decreases in per capita waste to landfill since the launch of their ZWtL initiatives; however, these decreases have been limited as a result of continued high levels of reported total per capita waste generation, particularly in Canberra and San Francisco where total waste has actually increased since the launch of their respective campaigns (see Figures 1 and 4, respectively).

Planning for Zero Waste to Landfill

Each case study's ZWtL initiative was articulated publicly,[33,34,35,36] and in clear and sometimes bold language, as with Toronto Mayor Mel Lastman's declaration announcement:

"We need a plan which everyone can buy into so that by 2010 all our waste will be recycled, reused or composted. Task Force 2010 must find a made-in-Toronto solution that demonstrates leadership in waste diversion strategies and new solutions for the 21st century that move beyond the landfilling of garbage."[37]

These statements of ZWtL goal adoption included references to the notion that planning of some sort would be necessary to achieve 100 percent diversion, such as San Francisco's directive that their staff "develop policies and programs to achieve zero waste, including increasing producer and consumer responsibility".[38]

Each of the ZWtL initiative proponents, in launching their campaigns, made some reference to possible upstream 'top-of-pipe' measures for waste elimination, such as producer/consumer behavior change, government legislation, or research and development into materials.[39] However, in none of the cases was there an accompanying comprehensive plan which included details of how such strategies would be used to achieve the 100 percent diversion goal. Furthermore, there is scant evidence of subsequent concrete planning which was developed to implement these ideas. Accordingly, waste elimination measures were rarely implemented to any meaningful extent, in any of the case study locations. Instead, the years which followed the launch of the ZWtL initiatives generally saw little more than the implementation of downstream 'end-of-pipe' strategies, such as expanded recycling or the introduction of food composting programs.[40]

In the three case studies which have already run their course, this situation eventually led to warnings from within their local governments that the campaigns were not on track for success, signalling the likelihood of failure which eventually led to abandonment.

In Canberra, the ACT's Commissioner for Sustainability and the Environment released a report in 2000, four years after the No Waste by 2010 campaign was launched, in which concern was expressed that the initiative lacked comprehensive planning, and would likely fail without increased significant, combined, and well-structured support from government, businesses, and the public.[41] After these improvements did not eventuate, a subsequent report from a new Commissioner in 2007 included the opinion that it was unlikely that the ZWtL target was ever achievable, and a recommendation that the campaign be dropped in favor of a more realistic waste reduction goal.[42] By the following year, the ACT government had followed this advice and abandoned the initiative.[43]

When the City of Toronto, three years into its ZWtL campaign, reported on its success in meeting its first phase goal of 30 percent diversion, it also conceded that:

"it is unrealistic to believe we can recycle, reuse and compost our way to 100 percent diversion….The City will need to continue to explore new and emerging technologies that will allow us to manage the estimated 40 percent residual waste that will remain".[44]

33. Australian Capital Territory 1996, 1.
34. Christchurch City Council 1998, 2.
35. City of Toronto 2001, 1.
36. SF Environment 2003.
37. City of Toronto 2001, 1.
38. SF Environment 2003.
39. See Australian Capital Territory 1996, 12-13 and 18; Christchurch City Council 1998, 5-6; City of Toronto 2001, 4; SF Environment 2003.
40. See Australian Capital Territory 1996, 7 and 14-15; Christchurch City Council 1998, 3 and 7-9; City of Toronto 2001, 8-28; SF Environment 2003.
41. Office of the Commissioner for Sustainability and the Environment, ACT 2000.
42. Office of the Commissioner for Sustainability and the Environment, ACT 2007.
43. Australian Broadcasting Corporation 2009. Available at http://www.abc.net.au/news/2009-01-21/rubbish-target-purely-aspirational-stanhope/273440.
44. City of Toronto 2004a, 2.

Later that year, the City's New and Emerging Technologies, Policies and Practices Advisory Group released a report, in which they concluded that Toronto's 100 percent diversion goal was not achieveable, and instead a diversion rate of between 86 percent and 96 % could potentially be achieved via technological innovations.[45] In 2006 the City approved the purchase of a new landfill site within Ontario,[46] and by the following year the ZWtL goal was officially dropped, just six years after it was adopted.

Meanwhile, Christchurch City Council took only three years to abandon its ZWtL campaign, with the push for deserting the goal spearheaded by the same City Councillor who had previously championed its adoption.[47] Similar to the Toronto case, Christchurch's dropping of ZWtL coincided with its ongoing and eventually successful efforts to secure a new regional landfill site, in partnership with neighbouring councils and private waste contractors.[48]

San Francisco's ongoing ZWtL initiative, compared with the other three cases, has implemented a larger number of specific top-of-pipe measures, including green building standards,[49] environmentally preferable purchasing requirements[50], a bottled water ban[51] on city premises, and city-wide bans on styrofoam food ware[52] and plastic checkout bags[53]. The combined overall impact of these measures, however, represents only a partial addressing of the overall stream of residual waste, as reflected in the fact that around 500 kg/person/year is still going into landfill.

A notable example of the incompleteness of San Francisco's efforts to eliminate waste at its sources is the highly-publicized ban on plastic bags. Even after a recent revision increasing the scope of the original legislation, plastic bags are still permitted for bulk foods, to separate or protect sensitive items, to carry small hardware items, to carry prescription drugs, to keep delivered newspapers dry, and to carry or protect laundry or dry cleaning.[54] As well, plastic bags of many types continue to be available for consumer purchase. The net result is that in a city now widely renowned for its pioneering plastic bag ban[55], these items are still an ubiquitious part of the urban landscape.

A general observation which applies to all of the case study locations, based on site visits, interviews with stakeholders, and on the analysis of the policy decisions and actions which have taken place around their respective ZWtL initiatives, is that very little appears to have changed with respect to waste generation. Problematic items which defy attempts at diversion from landfill, such as food packaging, electronic devices, and a myriad of products designed for disposability, remain widespread and largely unaddressed, and the prevailing end-of-pipe measures such as recycling programs and resource recovery centres are simply not able to achieve results approaching zero residuals to landfill. Canberra, Christchurch, and Toronto abandoned their initiatives in the face of looming failure, and while San Francisco's campaign remains ongoing, the evidence points to a similar outcome unfolding there by the year 2020.

The sections which follow include a discussion of recurring patterns observed in ZWtL initiatives, and how they might explain how and why these campaigns are consistently failing.

5. THE COMMON TRAJECTORY OF OBSERVED ZERO WASTE TO LANDFILL INITIATIVES

A notable recurring observation across all of the case studies is the overall chronological progression that each campaign appears to follow from its launch onwards. This common trajectory is illustrated in Figure 5, and the sections which follow it examine key components of this trajectory, as they are illustrated by observations from the four case studies.

45. City of Toronto 2004b.
46. City of Toronto 2007a.
47. Christchurch City Council 2001.
48. See Perriam 2002.
49. San Francisco Board of Supervisors 2004.
50. San Francisco Board of Supervisors 2005.
51. SF Environment 2007.
52. San Francisco Board of Supervisors 2006.
53. San Francisco Board of Supervisors 2007; San Francisco Board of Supervisors 2012.
54. San Francisco Board of Supervisors 2012.
55. Romer 2007.

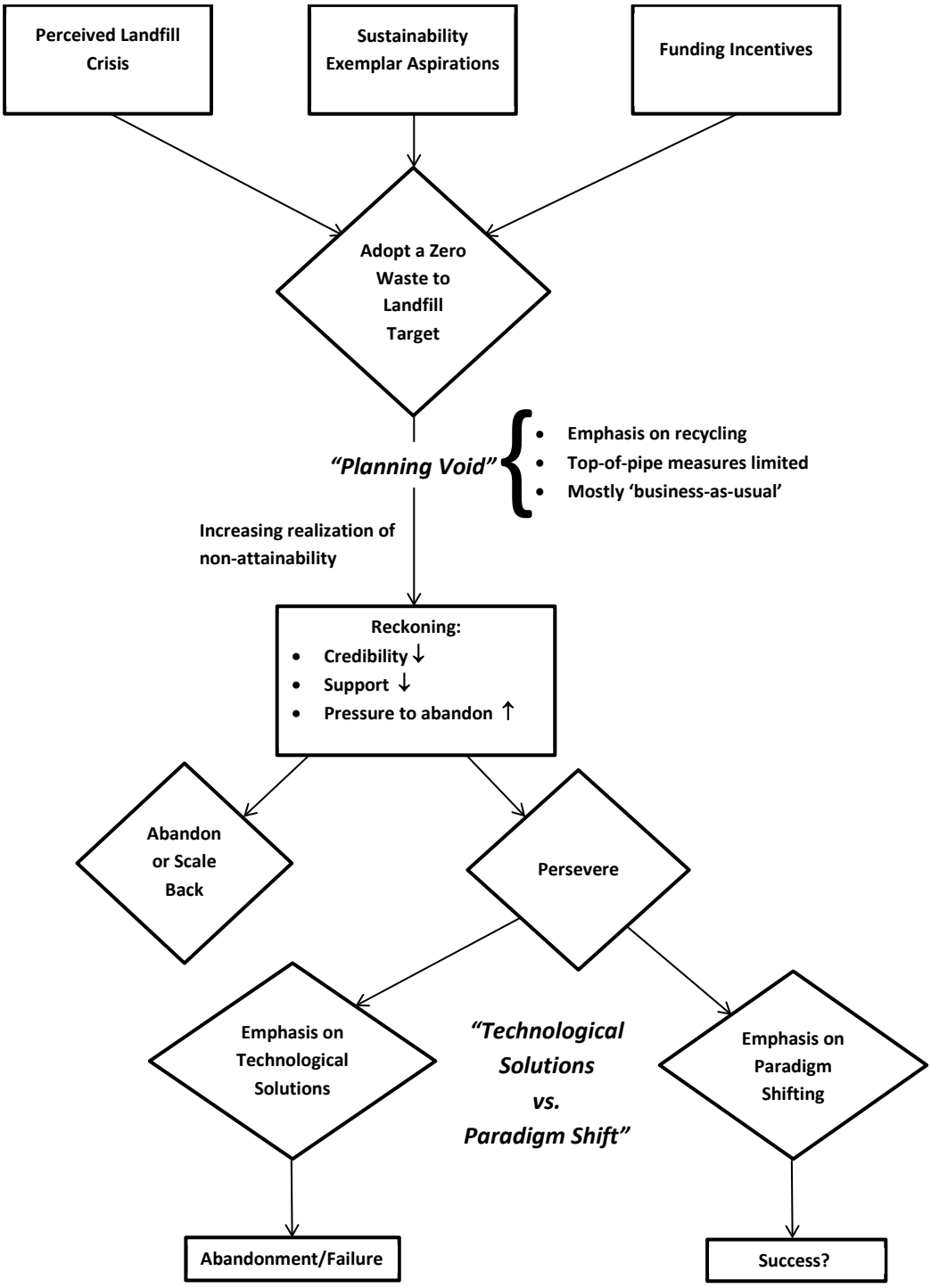

Figure 5: Common Trajectory of Zero Waste to Landfill Initiatives. Why Do Local Governments Declare Zero Waste to Landfill Goals?

The decision to undertake a ZWtL initiative appears to be based upon three different types of motivating factors. One of these is a *perceived landfill crisis*, whereby future landfill capacity appears to be in doubt, based on a shortage of available land near the community, or else on difficulties to gain public or environmental approval for a new site. Toronto's campaign was launched at a time when there were growing concerns that sufficient new landfill space might not be obtained,[56] while in Christchurch the initiative offered a hedging of sorts against the

[56]. *Flynn 2011.*

possible failure of ongoing attempts to secure a new landfill site.[57]

Sustainability exemplar aspirations can also lead proponents to aim for ZWtL . Canberra and San Francisco are examples of this: the former having promoted itself as the world's first local government to declare a ZWtL goal,[58] and the latter featuring zero waste as part of a wider public profile as a global leader in sustainability.[59]

Funding incentives, in the form of financial support in return for launching a ZWtL initiative, represents an additional type of motivation with particular relevance in cases where there would otherwise be little likelihood of adopting such a goal. None of the case study locations fall into this category; however, the majority of local initiatives launched across New Zealand around the time of Christchurch's campaign are examples of this.[60]

The 'Planning Void', and Subsequent Period of Reckoning

All of the case studies shared in common a missing comprehensive plan for achieving 100 percent diversion, coinciding or following on from the launch of the campaign. This *planning void* is characterized by an emphasis on end-of-pipe over top-of-pipe strategies, and an overall 'business-as-usual' approach to waste-generating behaviors in spite of the ZWtL goal.

ZWtL initiatives generally experience an initial post-launch period during which there is very little questioning or second-guessing of the goal, and during which time the campaign is focused on the implementation of the mostly end-of-pipe strategies such as expanded recycling. These early years are typically marked by increases in the reported percent diversion rate – and as this tends to be the statistic of preference during this phase, these early results have a tendency to reinforce a positive image of the initiative's progress.

The more pertinent per capita waste to landfill data, however, eventually emerges to belie the success story presented via percent diversion figures. Once it becomes evident that per capita waste to landfill is either decreasing too slowly, staying level or increasing, there commences a period of increasing realization and public admission that the ZWtL initiative lacks comprehensive planning and sufficient across-sector support, and might therefore ultimately fail.[61]

During this phase, the initiative faces escalating challenges, including losses in credibility and support from various stakeholder groups, and increasing pressure to abandon or scale back the campaign, with additional external factors such as newfound additional landfill capacity exacerbating this pressure, as was notably observed in the Christchurch[62] and Toronto[63] cases.

A critical junction is thus eventually reached, at which time the proponent must decide between stepping back or continuing forward. Christhurch abandoned ZWtL at this point, while Canberra and Toronto chose to persevere. Meanwhile, San Francisco's initiative is still basking in the early glow of impressive reported percent diversion statistics,[64] and with seven years remaining until its 2020 target date it has yet to endure its period of reckoning.

Technical Solutions vs. Paradigm Shift

When the decision is made to persevere with a ZWtL initiative, it is by then better understood that there is a need to revise the overall strategy. This presents an opportunity to make a radical move: to switch focus from end-of-pipe strategies such as expanded recycling, which are not working, to top-of-pipe strategies involving across-sector behavior change. In other words, it is a chance to make a paradigm shift from linear waste management practices to circular zero waste ones.

[57]. Perriam 2012.
[58]. Australian Capital Territory 1996.
[59]. SF Environment 2013a.
[60]. Snow and Dickinson 2003.
[61]. See, for example, Office of the Commissioner for Sustainability and the Environment, ACT 2000; Christchurch City Council 2001; City of Toronto, 2004a.
[62]. Christchurch Press, September 8, 2001, WE6.
[63]. City of Toronto 2007b.
[64]. SF Environment 2012b.

In all initiatives observed, however, proponents at this stage have chosen instead to pursue an emphasis on *technical solutions*. Top-of-pipe measures are routinely mentioned as potential strategy elements, but there is typically little or no firm planning or commitment to pursue these options, whereas actual planning and commitment is invested mainly in end-of-pipe measures such as expanded resource recovery, as happened in Canberra,[65] or else in unproven or vaguely-defined 'new and emerging technologies', as in the Toronto case[66].

The persistent attachment that ZWtL proponents have to recycling in particular is a notable element in the overall preference for technological solutions. Recycling is a widely recognized means for recovering resources from present-day waste; however, it is also often criticized as being unfeasible economically due to unreliable markets for recovered materials.[67] Moreover, recycling is well understood to fall far short of reducing residual waste levels to zero,[68] making it a clearly unfeasible central component for any ZWtL initiative. Recycling is even cited by some critics as a net *detriment* to waste reduction efforts, as it is argued that its 'feel-good' image diverts attention, support and energy away from more meaningful strategies at the top-of-pipe.[69]

6. FAILURE TO PARADIGM-SHIFT: THE 'UNACKNOWLEDGED SUPERMEGAPROJECT'

In all of the case studies, the adoption of the ZWtL goal was heralded with clear language articulating the intention to end landfilling, along with rhetoric suggestive of a fundamental transformation from linear to circular systems thinking.[70] It is noteworthy, then, that in all cases the launch of the campaign was followed by the existence of a planning void, instead of a comprehensive plan for achieving the 100 percent diversion goal.

To better understand this apparent disconnect between goal-setting and planning for attainment, it is helpful to consider what ZWtL would actually entail. Dependence on landfilling of residual wastes is the result of the widespread existence of products made with problematic materials, including but not limited to:

Plastics in general – which are found in almost every category of human-made items;

Electronic devices such as computers, cell phones and televisions – which include plastics as well as other problem materials such as heavy metals;

Medical equipment;

Food packaging;

Automobiles;

Appliances.

Under present economic and social conditions, it seems highly unlikely that members of society would, en masse, willfully give up even a single one of these categories of items. And yet, the continued existence of any one set of these items by itself represents an obstacle to the attainment of ZWtL.

Achieving the 100 percent diversion goal would require a wholesale retooling of industry to phase out the incorporation of problematic materials, deep sacrifice from a public who would be required to give up many of the conveniences and utilities that they have grown to depend upon over the course of lifetimes, and strong leadership from government in the face of industry resistance and public apathy/antipathy. In other words, ZWtL is a *supermegaproject*.

However, in none of the observed ZWtL initiatives did the local government proponent openly articulate that the goal represented an undertaking of such massive proportion. In each case, there has been no overt message to industry that systems of production would have to be revised to completely eliminate the incorporation of problematic materials. And there has been no overt message to the public that getting to zero waste would mean that everyday things like computers, cars and food

65. See Australian Capital Territory 2004.

66. See City of Toronto 2005.

67. See, for example, Carroll 2012; Hoornweg and Bhada-Tata 2012; van der Werf and Cant 2012.

68. See, for example, Braungart, McDonough, and Bollinger 2007; Kumar et al. 2005; MacBride, as cited in Royte 2005; Watson 2009.

69. See, for example, MacBride, as cited in Royte 2005; Watson 2009.

70. See Australian Capital Territory 1996; Christchurch City Council 1998; City of Toronto 2001; SF Environment 2003.

packaging would have to disappear from their lives because they cannot be fully recycled. In other words, ZWtL, to date, have been unacknowledged supermegaprojects.

Supermegaprojects such as ZWtL operate against a very steep gradient of resistance, which consists of public apathy/antipathy, industry pushback, and government unwillingness to use their powers to enforce compliance. Against such strong opposing forces, supermegaprojects cannot succeed by accident; rather, they require fundamental and concerted cooperation across all stakeholder groups. Unacknowledged supermegaprojects, lacking the impetus to rally such necessary extreme effort, are therefore destined to fail.

The planning void is a direct consequence of ZWtL initiatives being unacknowledged supermegaprojects: since there is no recognition by the proponent of the magnitude of the endeavor, it follows that there is no recognized need for any comprehensive planning, beyond adjustments to existing and mainly end-of-pipe measures such as recycling. Similarly, the choice of technological solutions over paradigm shifting, which proponents consistently make if and when they decide to persist with flagging campaigns, is a further consequence of ZWtL being an unacknowledged supermegaproject.

Acknowledgement of these initiatives as supermegaprojects tends to finally occur once a formal decision is made to abandon them – at which point the proponent typically cites the extreme requirements of the undertaking as a justification for giving up and switching to a more 'realistic' waste management goal.[71] This appears to be the common way that ZWtL initiatives come to their conclusions: in the face of a reality check which happens too late.

7. THE WIDER SET OF ZERO WASTE TO LANDFILL INITIATIVES

While the in-depth analysis of policy decisions and actions, and associated discourse, has been limited to the four case studies, there has also been a more general survey of the wider set of global zero waste to landfill initiatives, conducted as part of the overall research.

As discussed earlier, a significant early finding of this study was that no evidence of 100 percent diversion attainment could be found in any of the ZWtL campaigns launched around the world. This includes examples such as Tauranga, New Zealand, which adopted its ZWtL by 2015 goal in 2001 and then abandoned it in 2010,[72] and Nelson, Canada, where a ZWtL by 2020 campaign started in 2003 has since faded into non-activity.[73]

Of the many ongoing ZWtL initiatives around the world, Kamikatsu, Japan's bid to end landfilling or incineration by 2020, is a notable example of a campaign cited as a waste reduction exemplar. This remote village of 2,000 residents declared its 100 percent diversion goal in 2003 in response to strict regulations on dioxin emissions which forced the closure of two incinerators. A notable feature of this initiative is the implemented system of sorting waste into no less than 34 different bins.[74] By 2005, Kamikatsu had reported a 90 percent household recycling rate; however, it is acknowledged by the community that closing the loop completely is a difficult challenge, as the remaining residual waste represents items that they are unable to recycle.[75]

ZWtL initiatives such as those in Tauranga, Nelson, and Kamikatsu would require further in-depth investigation, before the recurring patterns from the case studies could likewise be atttributed to them with the same level of confidence. From the cursory evidence, however, it does appear likely that these other ZWtL initiatives are unacknowledged supermegaprojects as well – lacking proper articulation of the magnitude of the undertaking, developing subsequent planning voids, and

[71]. See Australian Broadcasting Corporation 2009, available at http://www.abc.net.au/news/2009-01-21/rubbish-target-purely-aspirational-stanhope/273440; Christchurch City Council 2001; City of Toronto 2007a.

[72]. McPherson, Michele. "Zero Waste Plan Thrown Out". Bay of Plenty Times, June 10, 2010.

[73]. Author's interview with Nelson City Councilor Donna Macdonald, February 6, 2012.

[74]. McCurry, Justin. "Climate Change: How Quest for Zero Waste Community Means Sorting the Rubbish 34 ways". The Guardian, August 5, 2008.

[75]. Hill, Hislop, Steel, and Shaw 2006.

featuring inherent preferences for technical solutions over paradigm shifting.

8. CONCLUSIONS

Zero waste to landfill initiatives are consistently failing because success requires a paradigm shift from waste management to zero waste principles – and the proponents of these initiatives are not willing or able to effect this fundamental change.

While all of the ZWtL initiatives observed in this study were launched with official and unequivocal pledges to eliminate landfilling by specified deadlines, every single campaign also proceeded to fall into a planning void, instead of developing a comprehensive plan for getting to 100 percent diversion. Accordingly, all of these initiatives have either failed, or if ongoing are on a clear track for similar failure.

The apparent disconnect between formal goal adoption and the subsequent planning void can be explained by the fact that ZWtL initiatives are unacknowledged supermegaprojects: undertakings requiring enormous and unprecedented effort and transformation across government, industry and the public, yet lacking the overt signaling of such by the proponents that is necessary to elicit the required action.

The far-reaching influence of economic globalization means that local governments worldwide are extremely ill-equipped to achieve ZWtL on their own. Innumerable products, made with a myriad of problematic materials, flow into each community from untraceable sources, and as such local governments have virtually no control over the top of the waste pipe. Rather, local governments are empowered only to implement strategies at the end of the waste pipe, such as the recycling programs which are observed to be the main extent of significant action emerging from these campaigns. The irreconcilable reality is that, with all of the problematic wastes coming into their communities from places and through means outside of their spheres of control, local governments have lost the ZWtL battle far upstream, before the garbage reaches the curb.

For ZWtL initiatives to succeed at the local level, there must be some means to prevent 100 percent of problematic wastes from entering the waste stream in the first place. Under present conditions, this appears to be impossible to achieve, and therefore it would seem unfeasible for any local government to declare such a goal.

One hypothetical scenario for ZWtL success is where a local government imposes its own total ban on allowing problematic materials into the community's waste stream. Such a strategy would depend upon the development of an extremely localized and self-reliant economy, which was able to provide the community with goods that satisfied all criteria for zero residual waste – something more or less unprecedented since the advent of the globalized consumer marketplace several decades ago.

It appears much more likely that ZWtL attainment could be approached through intervention from higher levels of government: national or even supranational. This is consistent with the fact that problematic wastes are flowing into communities from sources all over the world: ie, the top of the waste pipe sits mainly at the global level, so it is logically there where control over the waste stream could most successfully be asserted. For this reason, any local government not prepared to take drastic and unprecedented local steps of their own to enable a shift to ZWtL will likely have to lobby and/or wait for fundamental change to come from higher levels of government before 100 percent diversion can be realized in their community.

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